CHAPTER XXI

Yew Bow Making

By Dr. Harold G. Goldberg

AMONG poets the yew tree has become synonymous with the weapon which is made from it and thus we read of the twanging yew, the yew obedient to the shooter's will. "Sons of Luth," says Ossian, "bring the bows of our fathers, let our three warriors bend the yew." So it is not only true that the yew has always been associated in history with the long bow, but down to the present time no other wood has ever been found in bow-making to take the place of this classic tree. The tree, *taxus baccata*, is an evergreen which sometimes attains great size. According to the encyclopaediac descriptions, "specimens of remarkable antiquity are commonly seen in old church yards. The timber is extremely durable and valuable and was formerly much used in making bows. Its leaves and young branches act as an acrid poison when eaten by man and the lower animals. It seems to be a native of almost

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every country of a temperate climate, the finest specimens being found in Spain and Italy." Wood from these two countries was so well known and held in such high regard in England that during the reign of Edward IV a law was devised compelling the wine merchants of Spain and Italy to deliver a certain number of yew staves with every cask of wine imported into England. In the United States the yew is found in the State of Oregon and in many other parts. Some of the finest specimens of the wood have been taken from the Cascade mountains of Oregon. The tree is cut during the months of November, December, January and February when the sap is down and then split and seasoned in the log. It is in this form that it is generally supplied by the dealers.

Yew bows are of two principal kinds, self and backed. The former is made up of two single sections of wood, joined at the handle, while the latter is made up of two sections of wood joined at the handle, each section composed of two or more pieces of wood or other substances glued together longitudinally. Yew bows are made of two sections of wood rather than of one continuous piece because

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it is desirable to secure two limbs of as nearly the same growth as possible. Were the stave of one piece, one limb would be of different density than the other, owing to the difference in the age and development of the two parts. The belly of the bow is always the rounded portion nearest the shooter, during the act of drawing and the back is the opposite surface, a flat arc, always white in color. The color of the belly of a yew bow varies from a deep chocolate shade to a golden yellow, the color commonly seen being a light yellowish red.

Of all the woods used in the manufacture of the self bow, yew is the wood *par excellence.* It is light in the hand, sweet of cast, steady of aim and has great propulsive power. To obtain a perfect piece is such a difficult matter that one is scarcely ever seen. A perfect stave should possess a fine, close grain which should be even and straight, the line of demarcation between the white sap and red heart should be well defined, and not thickened by a blur of purplish discoloration which in some cases is evidence of decay. It should be free from knots, pins, curls, season checks, galls, wind checks and pitch pockets. Do not let the amateur bow-maker

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be discouraged, however, by this detail of imperfections, because very good bows may be made from staves exhibiting many of these faults. It is just such difficulties in fact, that the bow maker must encounter, that makes the art of bow making so fascinating, while the planning of a bow from an imperfect stave incites the ingenuity and skill of the maker to a point of greater endeavor. Were a piece of wood without the imperfections enumerated easily obtainable, anyone without even an ordinary amount of skill and with few tools might turn out a very serviceable bow. Such not being the case, however, the various faults must be met with each in its turn and conquered in a way best adapted to each individual piece. The tools needed in bow making are as follows: A hatchet, cross-cut saw, rip saw, jack plane, finishing plane, large and small spokeshave, a Stanley scraper, a coarse and fine file, a glue pot suspended in a water bath, and a vise workbench.

The log-sections are generally 3 feet 6 inches long by 6 or 8 inches wide by 3 or 4 inches in thickness. The bark is first removed and if the log is fairly straight in grain

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and has not many bumps or knots upon its outside or sap surface, it is cleft its entire length with a hatchet. Should the grain appear to twist or turn, which may be determined by comparing its two extremities, it is safer to saw it in as nearly a straight line as possible. Before either of these operations is attempted, the line of cleavage should first be determined with due regard for the irregularities upon its sap surface, so that the limb should be as flat and straight upon its back as possible and finish at the extremities with the lines of separation between the sap and heart parallel to each other. It will require, as a rule, careful observation to obtain this result, but the effort is well repaid as the subsequent steps of the process are much simplified.

Perhaps of all the woods from which bows are made the yew is the most uncertain in quality. A beautiful log may turn out the most disappointing staves, so the beginner must not be discouraged by such results, if he ever expects to succeed, as these logs are almost certain to be met with; most likely upon the first occasion.

The limb now having been produced, we proceed to shape it. The sides are first

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straightened with a jack plane until the block is 1½ inches in thickness. It is then set in the vise and the back formed. This is a very important step in bow making and great care must be exercised to obtain the necessary result. Taking the actual plane of the tree, which in the log is of course slightly rounded, as the plane of the back to be established, the spokeshave is drawn carefully backward and forward until the sap has been reduced throughout its entire length to ¼ inch in thickness. This will produce a barely perceptible curve which is to be retained until the finish of the bow. The curve of the limb must be followed, the tool dipping with the depressions in the heart, preserving the same proportion of sap to heart the whole length, i. e., ¼ inch in thickness.

Often it will be found that the sap dips more deeply into the heart upon one side of the limb than the other. In this case the side upon which the sap is thinnest must be selected and the peculiarities of the wood followed upon this side. In such a case should the sap upon the opposite side dip very deeply into the heart, the ¼ inch may be sacrified somewhat for the sake of flattening

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the general plane of the back, otherwise our relation of sap to heart would be considerably out of proportion. Except in the white portion, yew is a very soft wood, in spite of what some text books would lead us to believe. It is compact, but of about the cutting consistency of white pine. We must therefore use great caution with our spokeshave, working carefully in both directions, following the leaves or feathers of the grain, as they run first in one direction and then in the other. A too vigorous stroke will sometimes raise a sliver of wood that will penetrate so deeply that our stave may be ruined.

Having shaped the two limbs about 1½ inches in thickness and established our back a flat arc ¼ inch in thickness, at a perfect right angle to our roughly planed sides, we now proceed to cut the splice. This is accomplished as follows: A piece of drawing paper is obtained, being somewhat thicker than ordinary writing paper and two parallel lines are drawn upon it. Our splice is to be a fish tail 3½ inches in length by 1¼ inches in width. This is marked out upon the paper.

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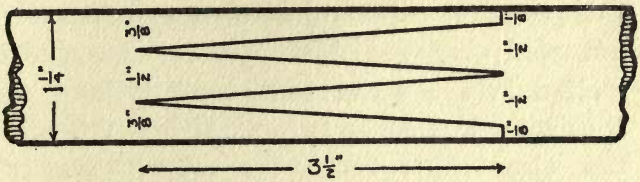

The lines are divided with a knife and separated, and the two sections thus formed pasted one upon each limb at its extremity. We have first decided which extremity this is to be, selecting the end of the limb containing the greater number of imperfections in the wood, since this portion of the finished bow is to be the thicker, and consequently less apt to fracture. The paper having been pasted upon the wood, sighting along the back to determine whether it is parallel to the sides, the limb is placed upright in a vise and we proceed to cut the splice. This step requires considerable skill as much depends upon its successful result. Taking the sharp rip saw we cut through the lines in the paper pattern, being careful to saw always in the same plane from top to bottom.

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The splice cut, it must next be glued. For this purpose ordinary joiner's glue is selected, not cold prepared liquid glue. The glue is melted in the water bath until it is of the consistency of sugar syrup. If it is too thick the vise will squeeze the segments apart, while if it is too thin, the wood will absorb too much of it, so it is important to have it just right. It is better to set back, or reflex, the limbs somewhat from a straight line, about ½ inch being a safe angle, so before the glue is applied, the two limbs are fitted together and this angle marked with lead pencil as a straight line along both sides, well beyond each extremity of the splice. When the limbs are glued and joined after this we simply preserve the continuation of these straight lines and our splice is then at an exact angle we have determined that it should be. The splice is now covered upon all its surfaces with two or three coats of glue and placed in the vise, the sides of the limb protected, if the vise is of metal, by interposing a piece of soft wood between the jaws and the wood. It is squeezed tightly, not enough to crush the wood and allowed to remain for two days.

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We now have a stave something more than 6 feet in length and it is time to proportion our bow. The stave is placed in the vise for the sake of convenience, the irregularity over the surface of the splice caused by setting back the limbs is shaved away, and the measurements are proceeded with as follows. Taking the 3½ inch splice as our basis of measurement, it is divided into half, marking a line in lead pencil, 1¾ inches from each of its extremities. The middle of the bow is to be one inch above the center of the splice, which point is also marked off in lead pencil. The rest of the operation is very simple. Lay a rule upon the back of the stave and measure off 3 feet from the line which has been placed 1 inch above the middle of the splice, i. e., that which is to be the middle of the bow, a mark is made upon each extremity of the stave, and the excess wood cut off. If a measurement is then made from each end of the splice to each end of the stave, it will be found that one limb is 2 inches longer than its fellow, which are proper proportions for a 6 foot bow.

(See diagram.)

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The outline of the back of a yew bow differs from those of the denser woods, such as lemon and lance, in that instead of inclining in a sharp straight line from the handle to the extremity, the back is made broader, inclining very gradually from the handle until within about one foot of the extremity it inclines more rapidly, ending in a sharp point for the reception of the horn. It is very important to obtain this correct outline because were we to adopt the pattern of the denser wood bows, our yew would be entirely too whippy at the ends, requiring too much wood in the belly and favoring the formation of chrysals, which in time would surely end in the destruction of the weapon. It is in fact its peculiar shape combined with the different character of the wood which makes the yew so soft of cast and consequently easy on the shooter.

We now plane down the sides of our stave, much care being exercised at this time to avoid raising splinters, until it is perfectly straight and is from 1⅛ to 1¼ inch in thickness, depending upon what the power of our bow is to be. About 1⅛ is assumed to be a good general average for a bow varying

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in weight from 40 to 45 pounds. A pattern is now made of paste board, first outlined in lead pencil and then cut with a sharp knife of the exact proportions of what our back is to be. This is laid flat upon the back and with a pencil a line is drawn upon each side of the pattern marking the outline upon the wood which is to be followed with the plane. The next step is to form the belly of the bow. Taking the *middle* and *not* the ends of the handle, as is the usual custom, we measure off for a bow which is $1\frac{1}{8}$ inches in thickness at the handle $1\frac{3}{16}$ inches from the surface of the sap into the heart of the wood. We measure off $\frac{5}{8}$ inch from the sap surface into the heart at each extremity, and then draw an irregular line, assuming that the stave is irregular in form from one point to the other. If much wood remains beyond this line, for the sake of saving ourselves considerable labor it may be sawed off with the rip saw, keeping beyond the line somewhat to avoid error. From now on the spokeshave comes into use, first rounding the sides, gradually approaching the summit of the belly until a perfectly rounded form is obtained. This is the most difficult step in

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the whole process of the undertaking, as the grain of the wood varies so constantly that we must always be on the alert to follow its peculiarities. We may now take our Stanley scraper, it being no longer safe to continue the use of the spokeshave, and complete the form of the belly. Every curve in the back of the bow must be carefully followed. In shaping the belly, gradually tapering toward the end, pins must be raised; by this is meant leaving a little more wood over the surface of the small black points that appear in the wood. Any other imperfections must be provided for in the same way. As has already been stated, in choosing which end of the limb is to form the handle, we have paid due regard to the imperfections of the wood. Keeping in mind that the principal bend in the bow is between a point 17 inches from the handle to within 8 or 9 inches of the end, we adjust the limbs accordingly. To secure the splice a strip of soft wood somewhat wider than the back of the bow and 3½ inches in length is glued over the joint, pressed in the vise, allowed two days to dry, and finally rounded in shape with the plane and file until it takes the general symmetry of the

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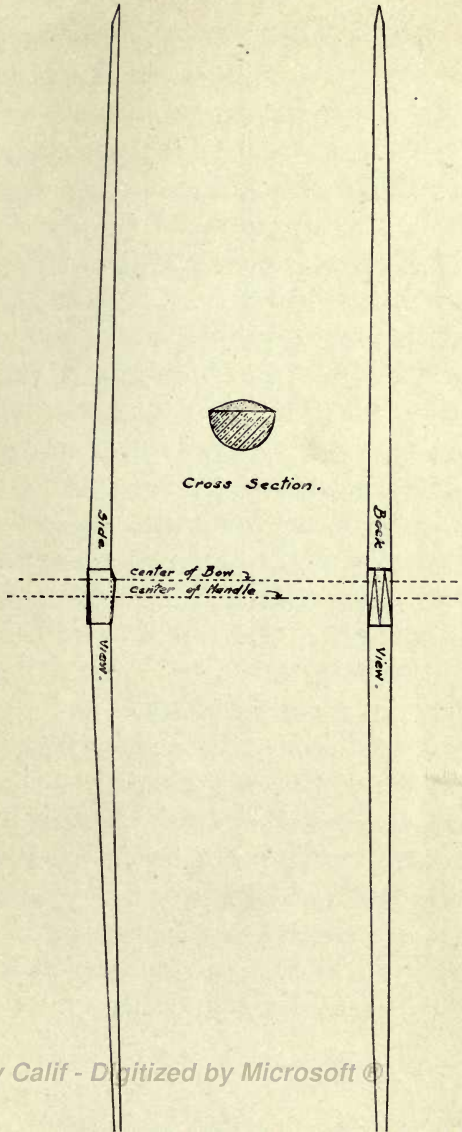

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handle. It should have the same lines as upon the belly side, more wood being allowed to remain at the corresponding center than at either extremity, which end in a gradually sloping angle. (See illustration.) This must be further secured by wrapping it with a thin layer of raw flax saturated with joiner's glue and smoothed to an even surface. After this is dried hard and further shaped with a file, a coat of shellac is applied to render the joint moisture- and sweat-proof.

This method of centering the bow was suggested by Dr. S. T. Pope, of San Francisco, Cal., an expert amateur bow maker, and so far as the writer knows, the method originated with him. It seems the most effective scheme yet devised by any bow maker and having once handled a bow of such proportions, it will be found that it balances perfectly upon that portion of the hand into which it most comfortably rests, giving a steadier aim and allowing less chance for error in every detail.

The horns are next put on. Their openings should be ½ inch in diameter, or not less than $\frac{7}{16}$ inch. They are carefully fitted to the end, filing away the wood until this is accomplished; cold (liquid) glue may be used to

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secure them in place. After they have dried, the bow is ready for tillering. The tiller is a staff of wood about 3 feet in length with a depression cut at its top to receive the middle of the bow, and notches cut down its face at intervals of several inches to a final depth of 26 inches. The tiller is placed upright in a vise and the bow braced. Before proceeding any further we turn the braced bow back up and then down, sighting first along one surface and then the other. This is to determine whether the back is perfectly flat and the string cuts the bow exactly into halves from notch to notch. Should the bow be cast to one or the other side, we may be assured that it is ill proportioned and that there remains too much wood upon the side toward which the deflection is formed. This is removed by means of the file or scraper. Now holding the bow at a transverse angle and satisfying ourselves that the curve of the limbs is about equal, the handle is placed upon the tiller and the string drawn to the first notch; in effect a great cross bow. As each successive notch is reached, gradually approaching the full draw, we step away from the tiller and observe the curve of the par-

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tially drawn bow. This observation must be made quickly, removing the bow each time, stringing and filing and scraping until a perfect arc is produced, and the exact weight which the bow is to remain has been decided. We now finish the bow with sand paper, steel wool and powdered pumice until all file marks have been removed and the bow has reached a fine smooth surface. After this it is rubbed to a polish with boiled linseed oil and the final dressing applied. This may be either shellac after the method of French polish or colorless varnish may be used in order not to darken the beautiful shades of the wood. The French polish is applied as follows: Dissolve white shellac in 95% grain alcohol, making a solution the consistency of syrup. Prepare a pad of cotton enclosed within a bit of gauze or cheese cloth. Dip it first in a dish of shellac and then in a dish of linseed oil; rub the surface of the wood vigorously. Repeat until a high, smooth gloss is produced. By this method only one coat may be applied and subsequent attempts to add to this will only mar the original coat. The first coat is rendered durable and sufficient by repeatedly

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rubbing the bow, several times during the season, with beeswax held in turpentine, or ordinary floor wax. If varnish be used, as many coats as desired may be applied and this latter method is chosen in the case of backed bows, where it is necessary to coat the surface more heavily against the effects of moisture.

The handle may be covered with leather, rubber or bound with braid to meet the fancy of the workman, but best of all is a handle of cork. To produce this, cut strips of thin cork about ½ inch in width and winding them around the handle in water proof cement. The excess at each end is pared away, the cork smoothed with sand paper and the two ends secured by a binding of leather strips ⅜ inch in width, skived very thin. Should we care to further embellish our bow we may, before the finish has been applied, imbed a section of pearl or ivory just above the top of the handle upon the left side of the upper limb. This is the arrow plate for the protection of the wood against the abrasion of the arrow and, while it is not a necessity, it adds to the appearance of the finished bow. It may be shaped in accordance

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with the taste of the worker and placed upon the spot where the arrow crosses, excavating the wood just enough to receive it when it is glued into position.

Backed Bows

In describing backed bows, only two kinds will be considered, yew-backed-yew and raw-hide-backed-yew. Backed bows were originally designed to make use of selected portions of wood which were considered unfit for self bows. Perhaps a heart was serviceable and the sap useless and vice versa. Bow makers then would put aside these staves until such times as they had obtained two perfect sections each of heart and sap and from these would make up their backed bows. In selecting wood fit for the backed bow, we must first of all have a perfectly even grained section of sap. It may be slightly curved in either direction but it must be straight of grain and at least ¼ inch in thickness with the side which is to be glued upon the heart perfectly smooth upon its surface. It must also be entirely free from knots, pins and other defects. This is carefully sawed from its defective heart with a rip saw.

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In the case of the heart, however, we are allowed more scope in our selection. The grain need not necessarily be perfectly straight, since it is to be covered upon its back by the perfect reinforcement of sap and so we may utilize almost any kind of heart providing it is free from the glaring defects already described. It seems hardly worth while, however, to make a yew backed yew unless we have a heart free of all defects with the exception of an irregular grain, which may be entirely disregarded because it is generally possible to obtain such a piece free of blemishes, possibly a strip which has been sawed from one or more of our self bows, and which has been preserved for just this purpose. The heart section should finish in the block 1½ inches in width by 1⅛ inches in thickness, perfectly flat upon all its surfaces and preferably perfectly straight in form. We next make the two surfaces of sap and heart which are to be glued together exactly even, and this is not an easy matter but requires great care with the plane and file. The writer's method is to cut two blocks of some soft wood about 2 inches wide by 1 inch in thickness and as long as each limb. Now

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make transverse saw outs about 1 inch apart to a depth of 7/8 inches, using these blocks for the press which is to be placed upon the limb after the sections have been glued. All our parts are now arranged in order upon the work table and the heart section is laid belly side down at the edge of the table and quickly covered with a coat of glue previously melted in the water bath. The sap is likewise glued, placed upon the heart and next the 2 inch block of soft wood upon the sap. The more tightly the two sections of sap and heart are squeezed together, the more firmly will they adhere and to effect this result without all the tools the professional bow maker has at his command, the writer has found that the small iron screw clamps which may be purchased at any five and ten cent store will serve very well. Enough of these are secured so that they may be placed about three inches apart, using the under surface of the table and the block of soft wood as the two surfaces against which the clamps are screwed. These are placed quickly, screwed into position with the fingers, and finally tightened with pliers. At the end of three days they may be removed and at the end of a few more

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days we may proceed with the further steps. These are the same as described in the case of the self bow.

Raw Hide Backed Yew

The writer will attempt to describe the method of Dr. S. T. Pope, of San Francisco, Cal., with apologies to Dr. Pope for any errors that may appear in the text. Dr. Pope maintaining that the sap wood serves no part in the cast of the bow entirely disregards any irregularities which may appear upon its surfaces in the formation of his back and planes the surface to a common level, in some cases entirely removing the sap if it is necessary to produce this result. In every other respect the bow is built in the usual way. The bow having been shaped and the proportions obtained within a few steps of the finished bow, the points are filed at the extremities to receive the horns, a little more wood being removed from the back of the point to allow for the strip of rawhide, and the stave is ready for its rawhide back. This is obtained from the tanners. It is a calf skin used principally by makers of artificial limbs and is about $\frac{1}{16}$ inch in thickness.

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The hide is cut lengthwise into strips of 1½ inches in width. These are soaked in warm water for about ½ hour and are quickly painted upon their inner surfaces with melted glue. The limbs are treated in the same manner, the strips, first one and then the other are bound on at the handle, quickly stretched and bound at the tips. They are then smoothed and carefully bandaged their entire length with a gauze bandage. This dries over night and the overlapping edges are cut off with a pen knife and finished with a file. The horn tips are again fitted, glued, the handle piece of soft wood applied, bound, finished and shellacked and the bow is ready for tillering. This having been accomplished, it is sand papered, rubbed with steel wool and pumice powder, the rawhide sized with a thin layer of LePage's glue, rubbed with linseed oil and the bow finished in the manner previously described. While the writer cannot agree with Dr. Pope's contention that the sap plays no further part in the formation of the bow than a protection for the heart against fracture, he can enthusiastically commend the method to the bow maker, be he professional or amateur as one worthy of his

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best efforts. It is a far wiser and safer method for the beginner than either the self or yew backed yew and as for its shooting qualities, the writer has nothing more to say than that a beautiful fine grained dark mahogany yew bow made for him by Dr. Pope has stood the test of a season's shooting in the most delightful manner, finishing with no more loss of cast than one should expect to find in the finest bow, of any quality and without following the string to any excessive degree.

It is always best to allow the bow to remain idle for a year before it is put into active use for the sake of seasoning it in the form in which it is finished. The English bow makers take about five years in the manufacture of a bow, allowing one year to elapse between each step. While the writer cannot see any good reason for permitting so much time to these various steps, assuming that we are working on a stave already seasoned in the log, the fact remains that a well seasoned stave will give better results in the finished bow than a younger piece of timber. The wood darkens with age and in the bow increases in cast, so certainly some time should elapse between the finishing of the bow and the time it is

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put into use. Yew bows will follow the string to a certain degree and lose about 3 pounds in weight, no more, if the wood is properly seasoned and well proportioned. If the limbs are unequal in strength, the bow will lose cast and follow the string from this unequal strain, and will finally break; so all these points must be borne well in mind.

In conclusion let the writer say that he does not pretend to be a bow maker of any particular merit or even long experience. He does not claim that the methods mentioned are the best, but they are practical, and an attempt has been made to present them to the reader in a concise and comprehensible form, leaving nothing to be assumed. If he has succeeded in this, he will feel amply repaid for the effort. In this form they are offered to the reader with the hope that he will derive as much pleasure from their practice as the author.

"Thus when our sports are over,
In Autumn's final day,
Each Bowman sure will say;
Come, a parting cup,
Ay and bumper it up
To the next merry twang of the tough yew bow." (Dodd, 1818)

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